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**United States Patent** [19][11] **Patent Number:** **5,890,176****Kish et al.**[45] **Date of Patent:** **Mar. 30, 1999**[54] **OBJECT-ORIENTED DOCUMENT VERSION TRACKING METHOD AND APPARATUS**5,649,200 7/1997 Leblang et al. .... 395/703  
5,671,428 9/1997 Muranaga et al. .... 707/511[75] Inventors: **John W. Kish**, Roswell; **David A. Wittler**, Alpharetta; **Daniel F. Burkes**, Atlanta, all of Ga.*Primary Examiner*—Joseph R. Burwell  
*Attorney, Agent, or Firm*—Kudkirka & Jobse, LLP[73] Assignee: **International Business Machines Corp.**, Armonk, N.Y.[57] **ABSTRACT**

A single file holds multiple versions of a document composed of an interconnection of objects which themselves have versions and are stored in the file. When the document is changed by changing any of the interconnected objects, a check is first made to determine whether the object version is same as the document version currently being edited. If not, a copy of the object is made and saved. Any version of the document can be reconstructed by interconnecting object versions which have a highest level which is equal to, or less than, the desired document version. Therefore, only objects which are changed are duplicated and copies of objects are only made when an object changes. The interconnection of the objects to form structure of the document is maintained by an interconnection of object pointers. Each object has an associated demand loader object which includes a list of object versions for the associated object plus a pointer to one of the versions. The demand loader object also includes methods for loading the associated object into memory from storage when the object is accessed. In this manner, the whole document does not have to be loaded in order to be accessible.

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707/514, 515, 530, 203[56] **References Cited****U.S. PATENT DOCUMENTS**

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**23 Claims, 8 Drawing Sheets**